

Preliminary Validation TOPAZ - Gulf of Mexico

(Nuts and Bolts)

Dave Szabo

HYCOM NOPP GODAE Meeting 27-29 October 2004

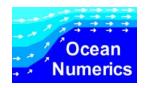
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Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and

Report Documentation Page

Form Approved OMB No. 0704-0188

Ocean FOCUS



Ocean FOCUS is a current advisory service using primarily satellite charts and the TOPAZ current forecast model

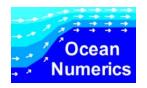


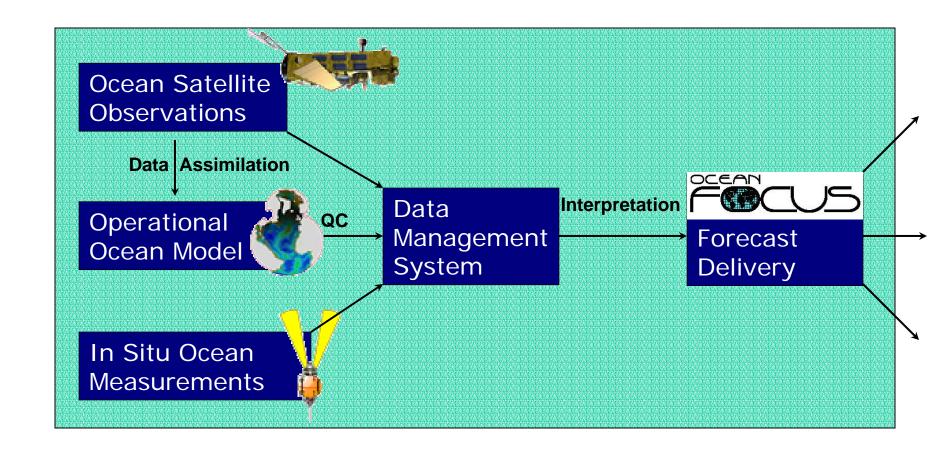




This is a service developed by the Ocean Numerics which is jointly owned by these three companies.

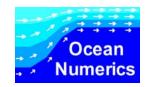
'Operational Routine'

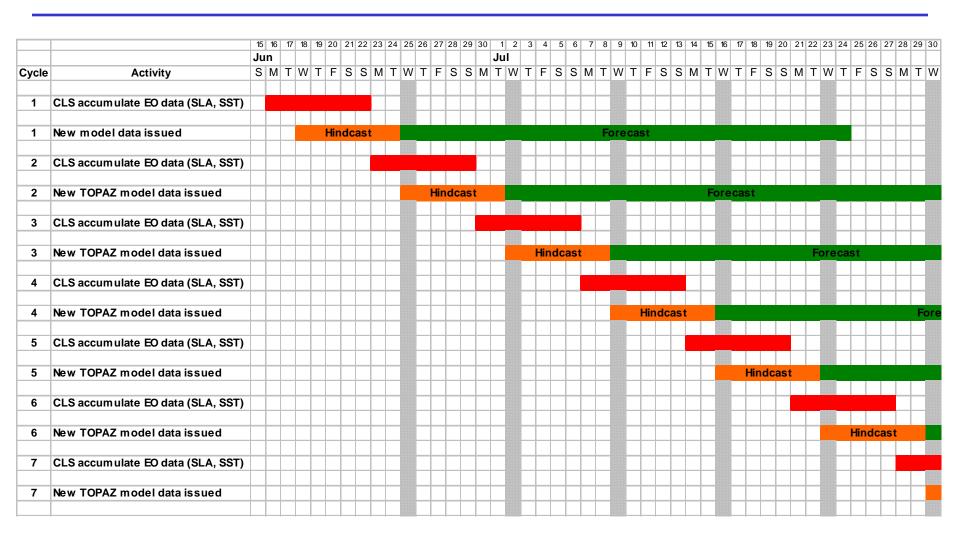




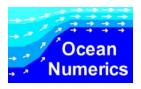
Ocean information to support operational decision-making by the oil and gas industry.

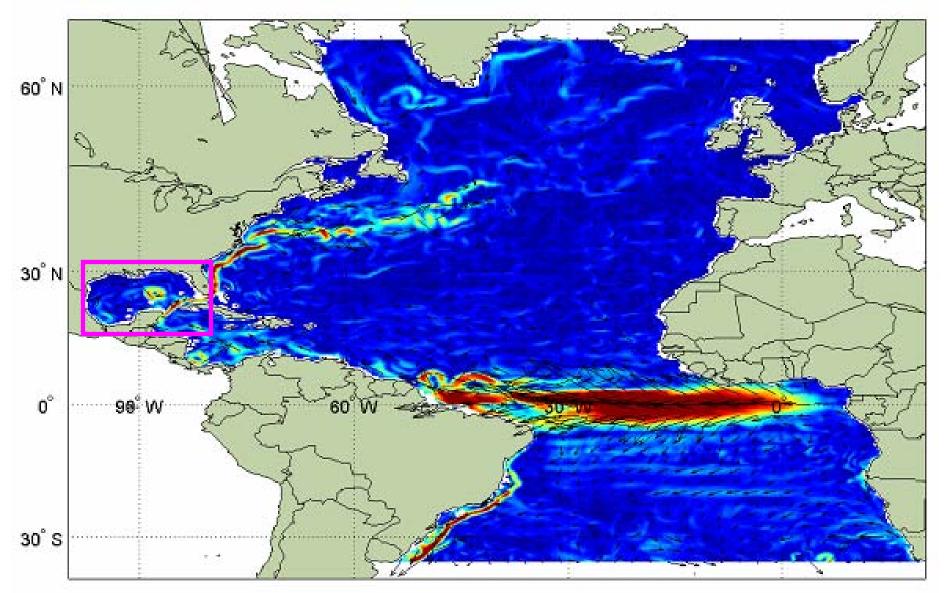
Operational Forecasting Cycle



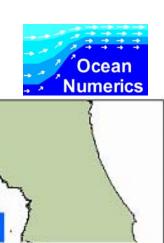


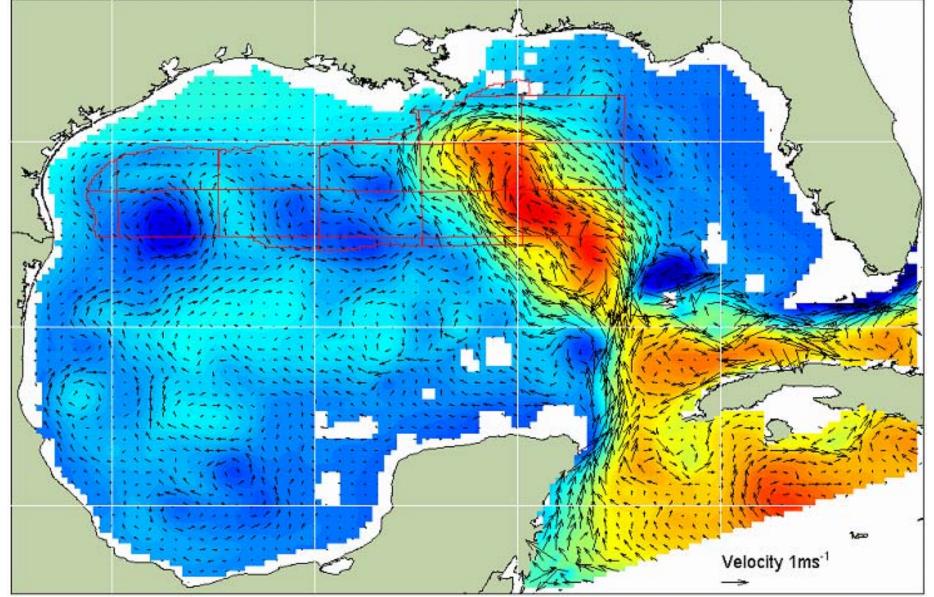
Nested Regional Model



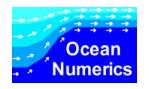


Forecast Velocity Field



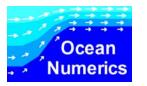


How we would use model validation



- Demonstrate expected accuracy to client what they can and can't expect
- Use as an aid in continued system development and improvement - continued validation.
- To answer questions like: How soon will the ring break off the Loop Current? How long will it take the front to reach my location? How long will the strong currents last?

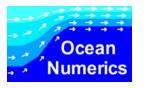
Validation - Demonstration of Skill



- This is the big story for us
- Industry clients need to be convinced that the model results can be useful

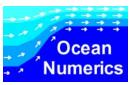
 Development by an international consortium and backing of the US Navy has merit but is secondary

Present Status

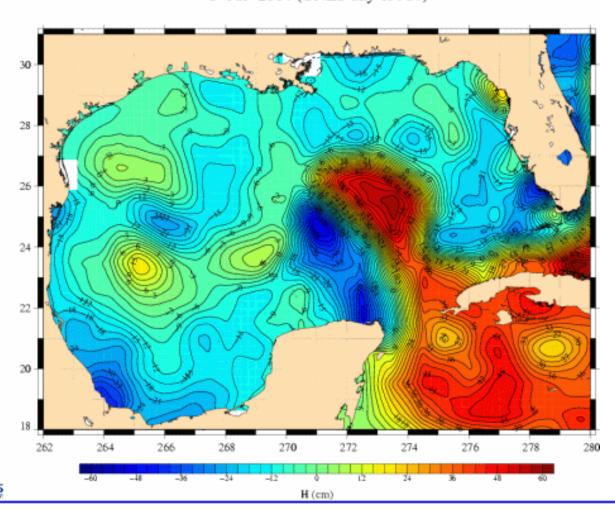


We will complete a four month Free Service Trial this week

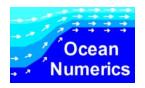
- Therefore we need to perform an initial validation as soon as possible
- We have started but have a long way to go





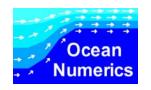


Some Validation Methods



- Visual comparison of SSH fields from model and satellites
- RMS SSH differences through forecast
- Overlay SSH contours on ocean 'color'
- Parametric fits to features ellipse fit to Rings
- Tables of occurrence of Loop Current / Rings
- Time series of measured and modeled current

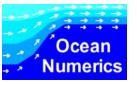
Visual comparison of SSH fields from model and satellites



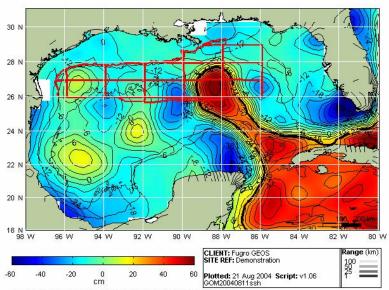
Very qualitative

Satellite 11 Aug 04

Satellite 18 Aug 04

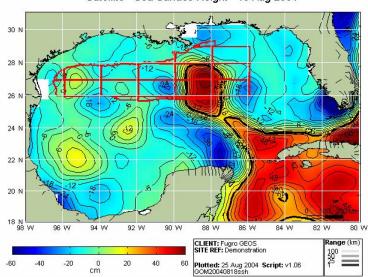


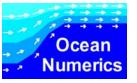
Satellite - Sea Surface Height - 11 Aug 2004

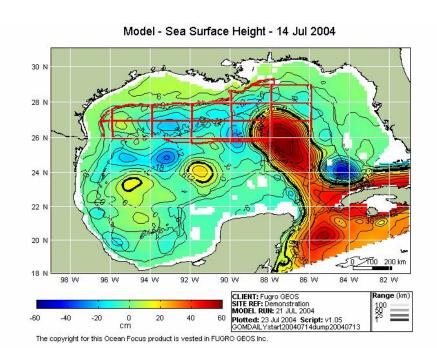


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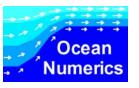
Satellite - Sea Surface Height - 18 Aug 2004



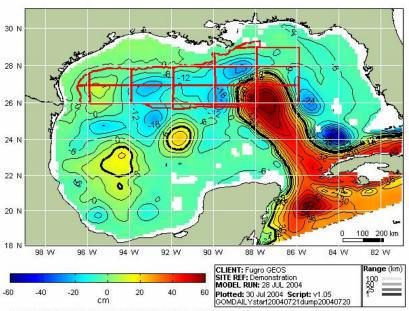




Model - Sea Surface Height - 11 Aug 2004 30 N 28 N 26 N 24 N 22 N 20 N 82 W 92 W 90 W 88 W 86 W CLIENT: Fugro GEOS SITE REF: Demonstration MODEL RUN: 21 JUL 2004 Range (km) Plotted: 23 Jul 2004 Script: v1.05 GOMDAILYstart20040731dump20040810 The copyright for this Ocean Focus product is vested in FUGRO GEOS Inc.

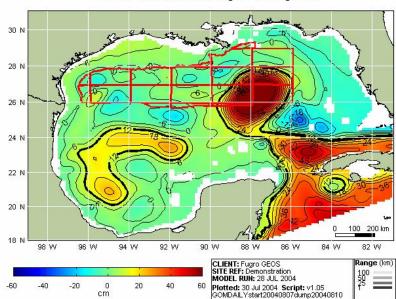


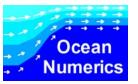
Model - Sea Surface Height - 21 Jul 2004



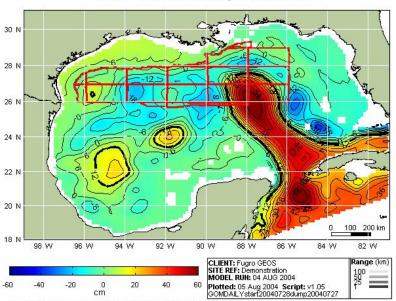
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Model - Sea Surface Height - 11 Aug 2004



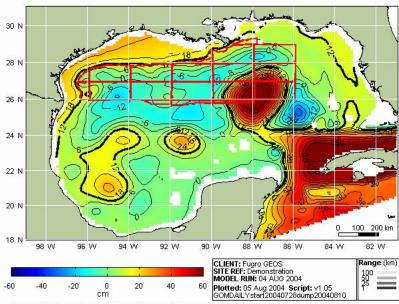


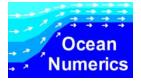
Model - Sea Surface Height - 28 Jul 2004



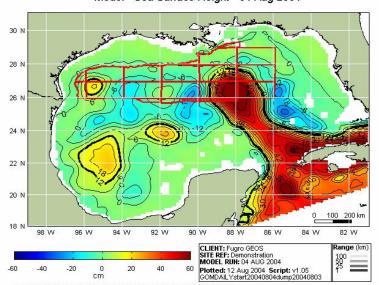
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Model - Sea Surface Height - 11 Aug 2004



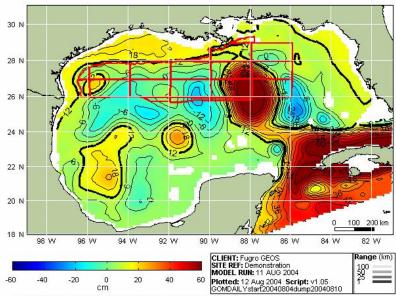






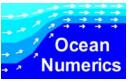
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Model - Sea Surface Height - 11 Aug 2004

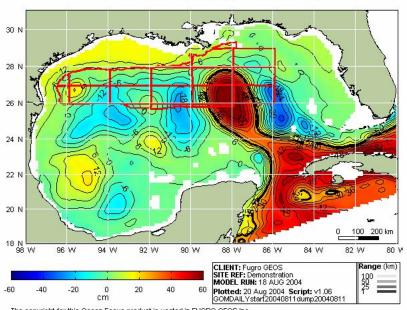


Analysis 11 Aug 04

Analysis 18 Aug 04

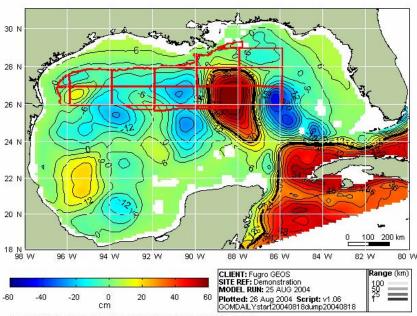


Model - Sea Surface Height - 11 Aug 2004

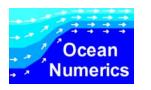


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Model - Sea Surface Height - 18 Aug 2004

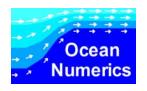


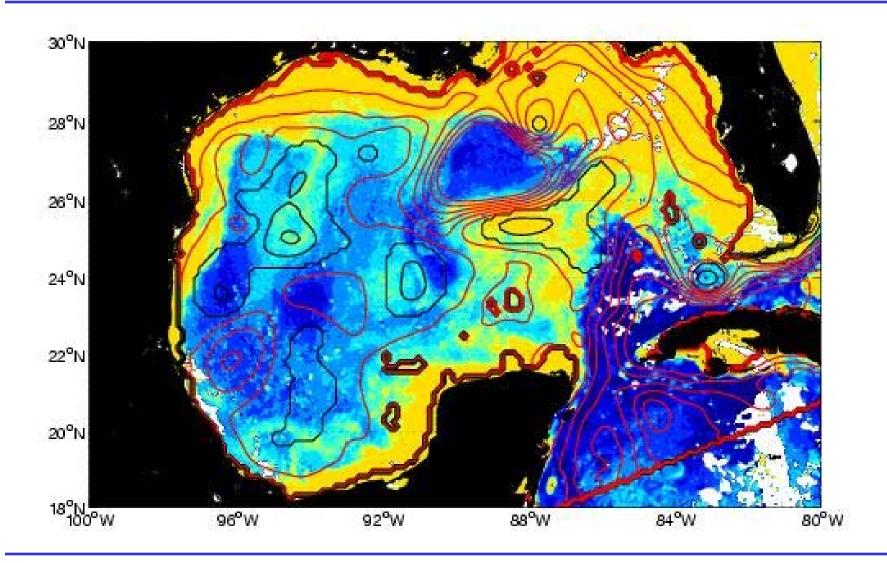
Overlay of SSH Contours on Ocean Color



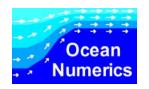
- Phytoplankton acts as tracer
- High concentration in coastal water
- Low concentration in rings
- Qualitative

Overlay of SSH contours on ocean color





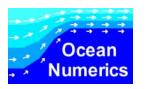
Parametric fits to features - ellipse fit to rings



Parameters:

- edge location
- lengths of principal axes
- orientation of axes
- ring area
- speed of rotation
- speed and direction of translation

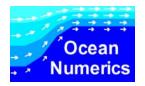
Parametric fits to features - ellipse fit to rings

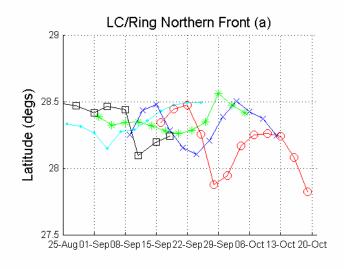


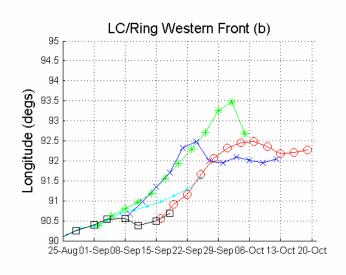
Difficulties:

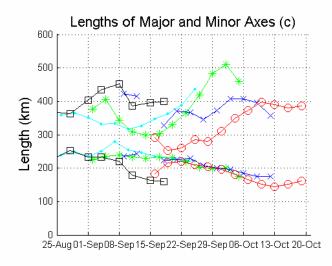
- sensitive to choice of bounding contour
- if contour too low may go outside of ring
- if contour too high lose portions of ring
- model and satellite charts have different mean sea levels (at present)
- Hurricane Ivan created a large SSH signal
- rings are not always well described as ellipses

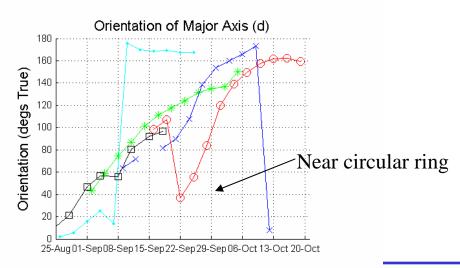
Ellipse Parameters



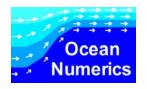


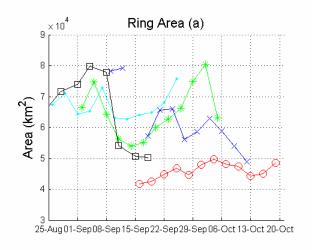


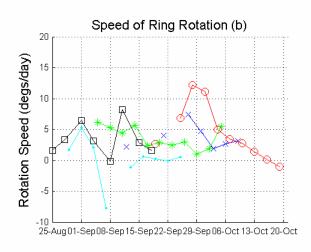


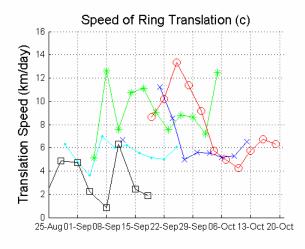


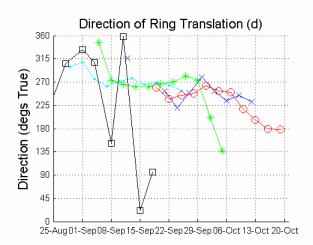
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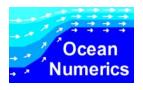






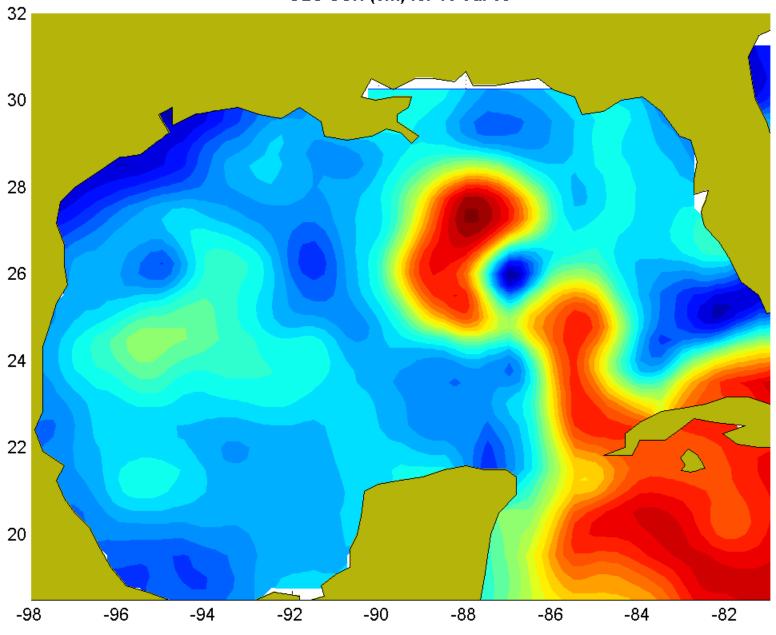


Following sequence

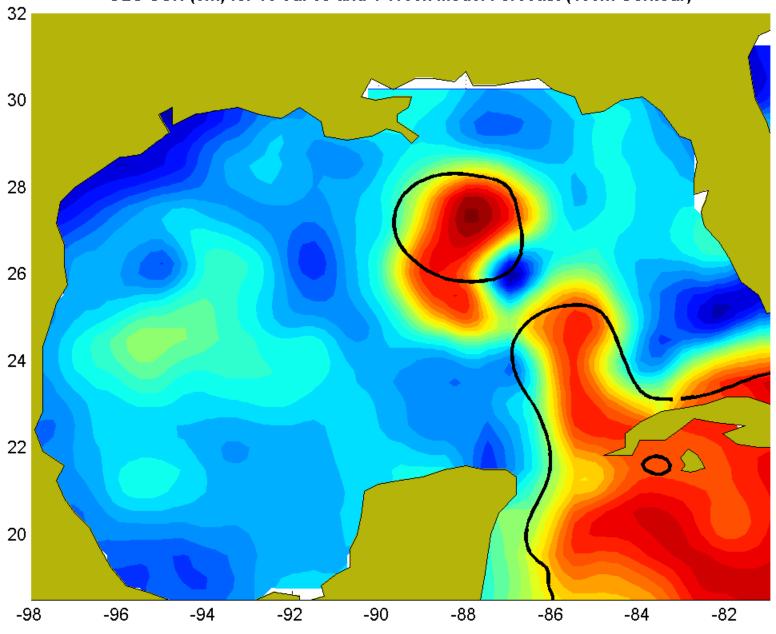


- Satellite SSH chart for 16 July 03
- Contour of 40cm from model at successive forecast times

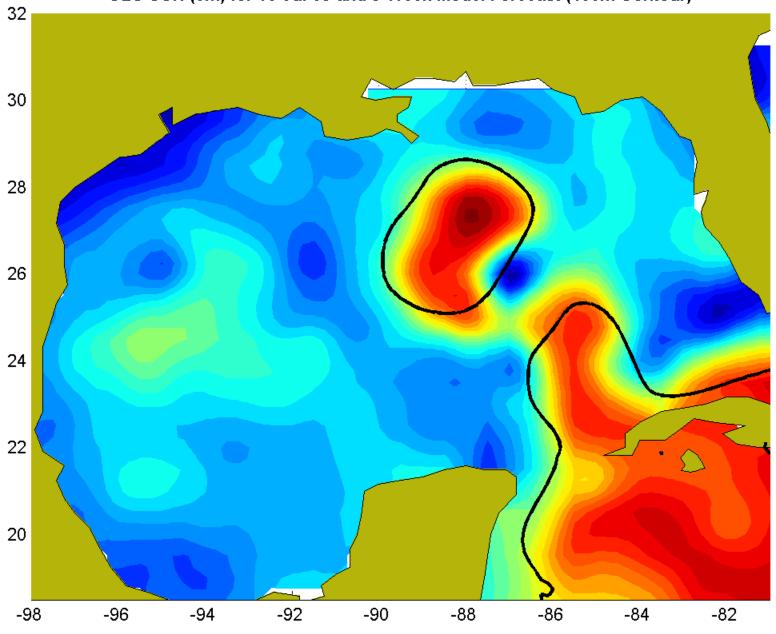
CLS SSH (cm) for 16-Jul-03



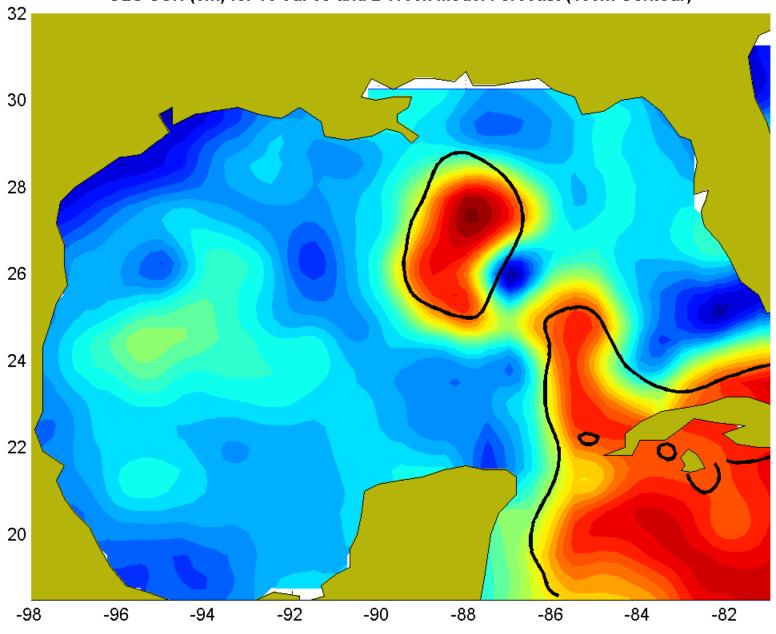
CLS SSH (cm) for 16-Jul-03 and 4-Week Model Forecast (40cm Contour)



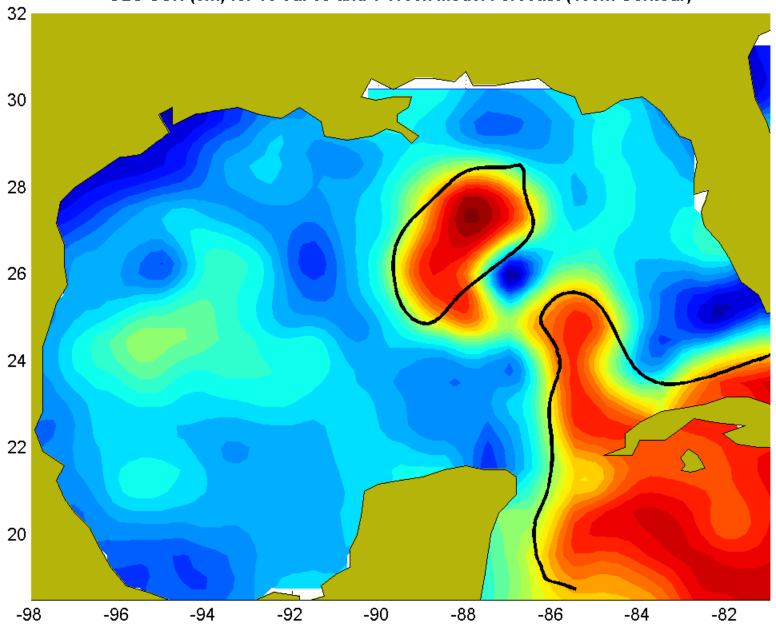
CLS SSH (cm) for 16-Jul-03 and 3-Week Model Forecast (40cm Contour)



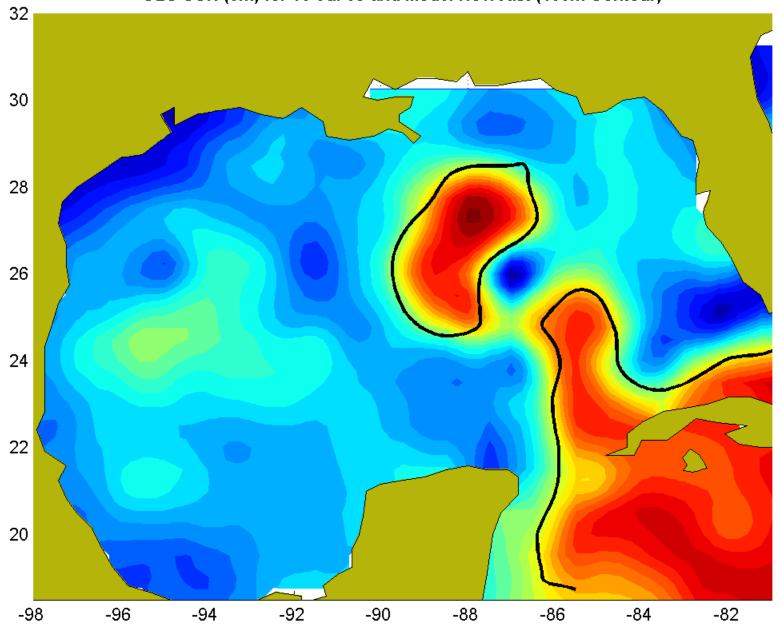
CLS SSH (cm) for 16-Jul-03 and 2-Week Model Forecast (40cm Contour)



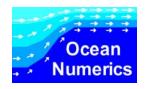
CLS SSH (cm) for 16-Jul-03 and 1-Week Model Forecast (40cm Contour)



CLS SSH (cm) for 16-Jul-03 and Model Nowcast (40cm Contour)

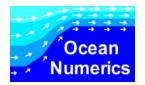


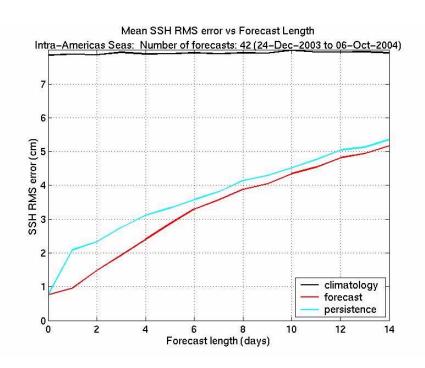
Tables of occurrence of Loop Current / Rings in specific areas by forecast

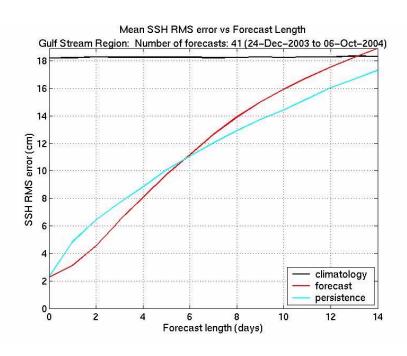


Area	DeSoto Canyon						
	Satellite		Nowcast (NC) + N days				
Date	(truth)	Analysis	NC	NC+7	NC+14	NC+21	
7-Jul-04	N	N					
14-Jul-04	N	N	N				
21-Jul-04	N	N	N	N			
28-Jul-04	N	N	N	Y	Y		
4-Aug-04	N	N	N	N	Y	Y	
11-Aug-04	N	N	SW	N	Y	Y	
18-Aug-04	SW	SWC	N	SW	SW	N	
25-Aug-04	SW	SWC	SWC	N	N	N	
1-Sep-04	Y	Y	SWC	N	N	N	
8-Sep-04	Y	SWC	SW	N	N	N	
15-Sep-04	N	N	Υ	N	N	N	
22-Sep-04	N	N	N	N	N	N	
29-Sep-04	N	N	N	N	N	N	
6-Oct-04	N	N	N	N	N	N	

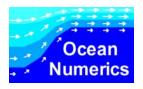
Mean SSH RMS Error vs Forecast Length

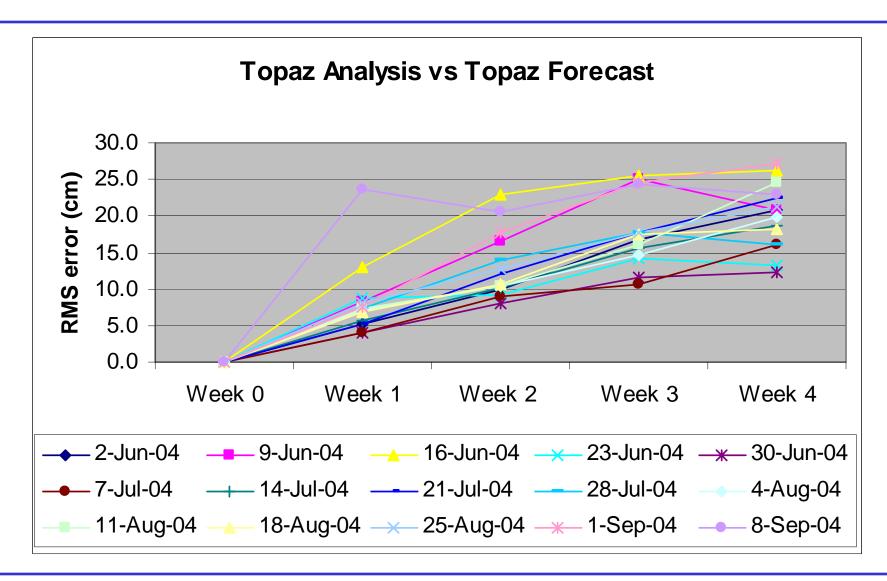




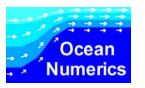


Mean RMS SSH Error by Forecast





Mean SSH RMS Error vs Forecast Length



- What is used for truth satellite or model?
- This is dependent on regional energy
- Is it dependent on grid resolution?